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Assessment and Deployment of Bird-Carried Meteorological Sensors for Microclimate Measurements in Urban Terrain

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The Cityflocks project has been developing and deploying lightweight, fast-response meteorological sensors to be carried by bird species in urban areas to address the paucity of measurements in the region a few hundred metres above the urban rooftops. Accurate and fast routine temperature measurements in this region will help further our understanding of the above-canopy internal boundary layer structure and the spatial variability of Urban Boundary Layers (Barlow 2014). Data implications include improving forecasting of Urban Heat Island events and urban weather, improving air pollution modelling and informing sustainable urban planning. Other methods of making such measurements routinely, such as using manned aircraft or Unmanned Aerial Vehicles (UAVs), can be prohibitively expensive or require onerous permissions and logistics to achieve.

A first-iteration prototype was carried initially by a trained White-tailed Eagle (Haliaeetus albicilla) and an Imperial Eagle (Aquila adalberti) to assess probe-mounting locations (back or tail mounted temperature sensor), other met sensors and the potential for data contamination due to heat generation by birds (Thomas et al. 2017). Other characterisation tests included car-mounted solar radiation shield tests, UAV-mounted tests for altimeter testing and field tests of temperature responses to solar-heated surface elements.

We present results demonstrating that packages meet their specified target of measuring at least a 0.5 degree celcius change in temperature over each hundred metres of flight track, as well as accurately recording their location and orientation using on-board GPS, 3-axis gyroscopes and accelerometers, and a pressure altitude sensor. The package has been miniaturised and carried by captive homing pigeons (Columba livia) for initial tests prior to more widespread deployment later in 2018.

1. Barlow, J.F., Progress in observing and modelling the urban boundary layer. Urban Climate, 2014. 10, Part 2: p. 216-240.
2. Thomas, R.M., et al., Avian Sensor Packages for Meteorological Measurements in Complex Terrain and Urban Environments. Bulletin of the American Meteorological Society 2017. (In press. Early release available: http://journals.ametsoc.org/doi/10.1175/BAMS-D-16-0181.1).